Sirex noctilio :Overview of Biology and Control

Nathan Schiff
USDA Forest Service
Southern Research Station
Center for Bottomland Hardwoods Research
P.O. Box 227
Stoneville, MS 38776
nschiff@fs.fed.us

Normally Dennis Haugen would give this talk.

Dennis worked on *Sirex noctilio* for 8 years in Australia

He authored the Australian control plan

Also worked on *Sirex noctilio* in South America

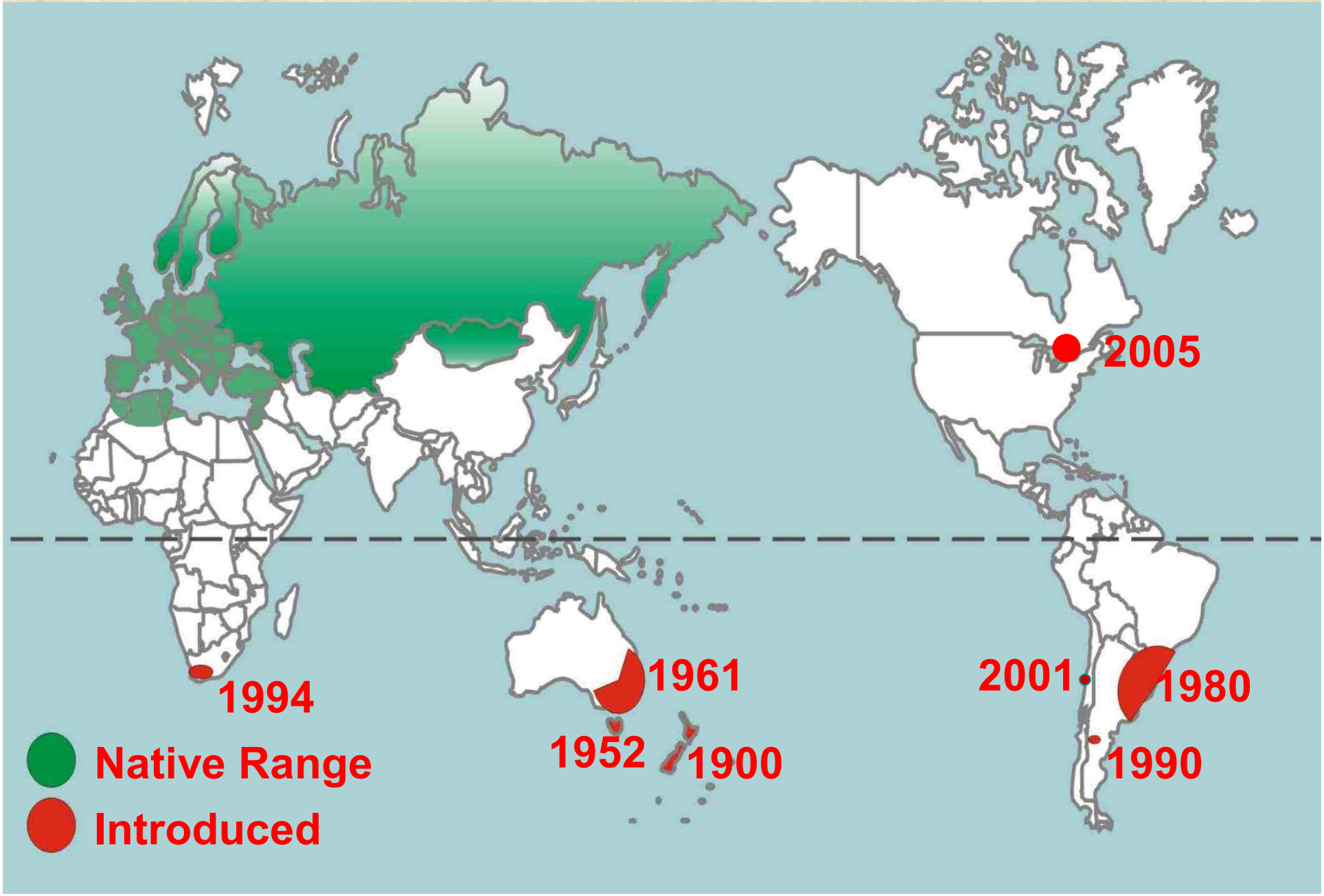
He took many of the pictures used here.

I have studied the biology of native and exotic siricid woodwasps that attack hardwoods and conifers for the last 10 years.

I work with Dan Wilson a plant pathologist who studies wood decay fungi.

Sirex noctilio Classification: Hymenoptera: Symphyta, Siricoidea

Sirex noctilio



Host range:

Native Range : Europe, Asia, North Africa

Hosts: *P. sylvestris, P. nigra, P. pinaster*

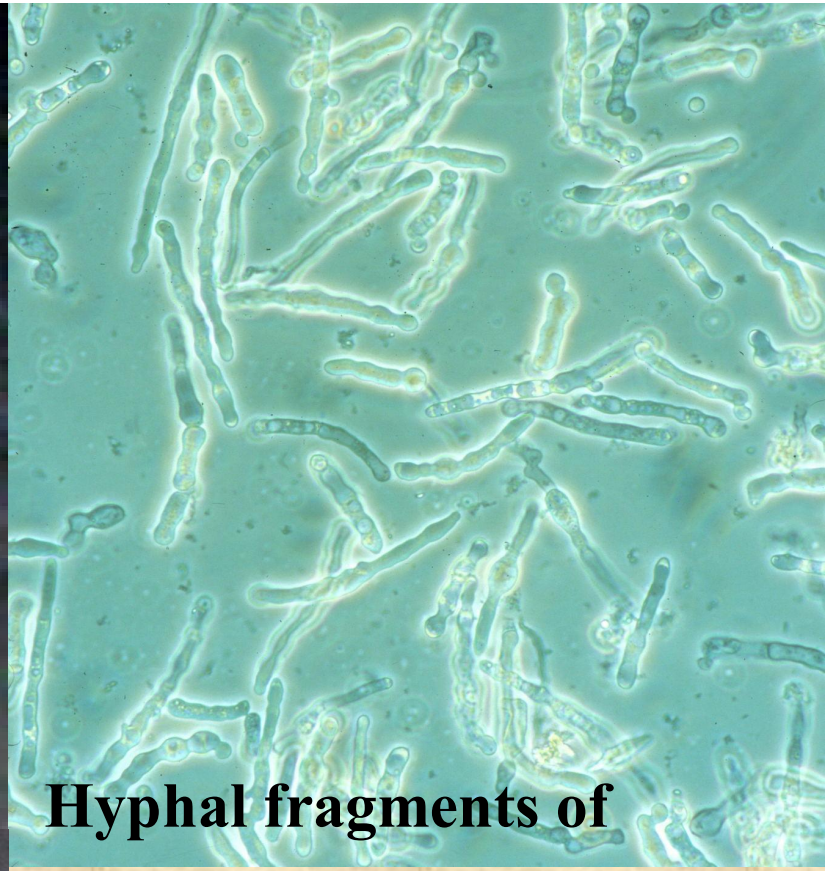
Introduced Range:	Hosts
New Zealand 1900	*P.radiata*
Tasmania 1952	*P.radiata*
Australia 1961,	*P.radiata*
South Africa 1994,	*P. radiata, P. patula*
South America 1980-2001	
Brazil	*P. taeda, P. elliottii*
Argentina	*P. banksiana, P. contorta*
North America 2005	*P. resinosa, P. strobus*

taeda =loblolly, elliottii =slash, banksiana = Jack, resinosa =red, strobus = white, contorta = lodgepole, radiata =monterey, patula = mexican weeping, sylvestris = scots, nigra =austrian, pinaster= maritime

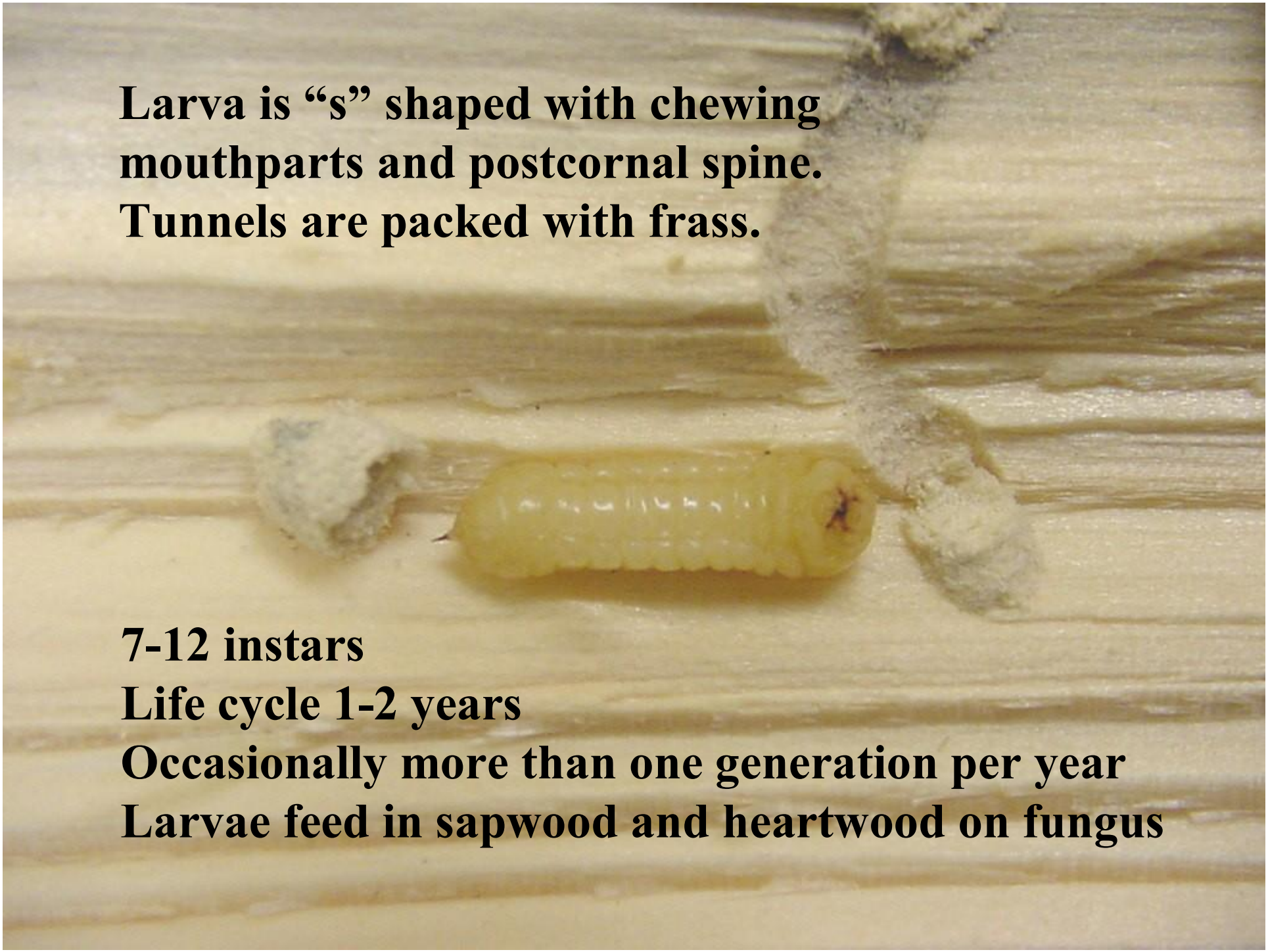
Biology:

Female *Sirex* mate with males in the crowns of trees and oviposit into the bole of stressed trees often half way up the tree.

Females also inject a wood decay fungus and a phytotoxic mucus into the wood.



The fungal symbiont of *Sirex noctilio* is *Amylostereum areolatum*



Larva is “s” shaped with chewing mouthparts and postcornal spine.
Tunnels are packed with frass.

7-12 instars
Life cycle 1-2 years
Occasionally more than one generation per year
Larvae feed in sapwood and heartwood on fungus

Effects of larvae, fungus and mucus

Yellowing needles droop

Leaves redden as the tree dies

Sirex noctilio indicators

Fungal Staining

Dripping Resin

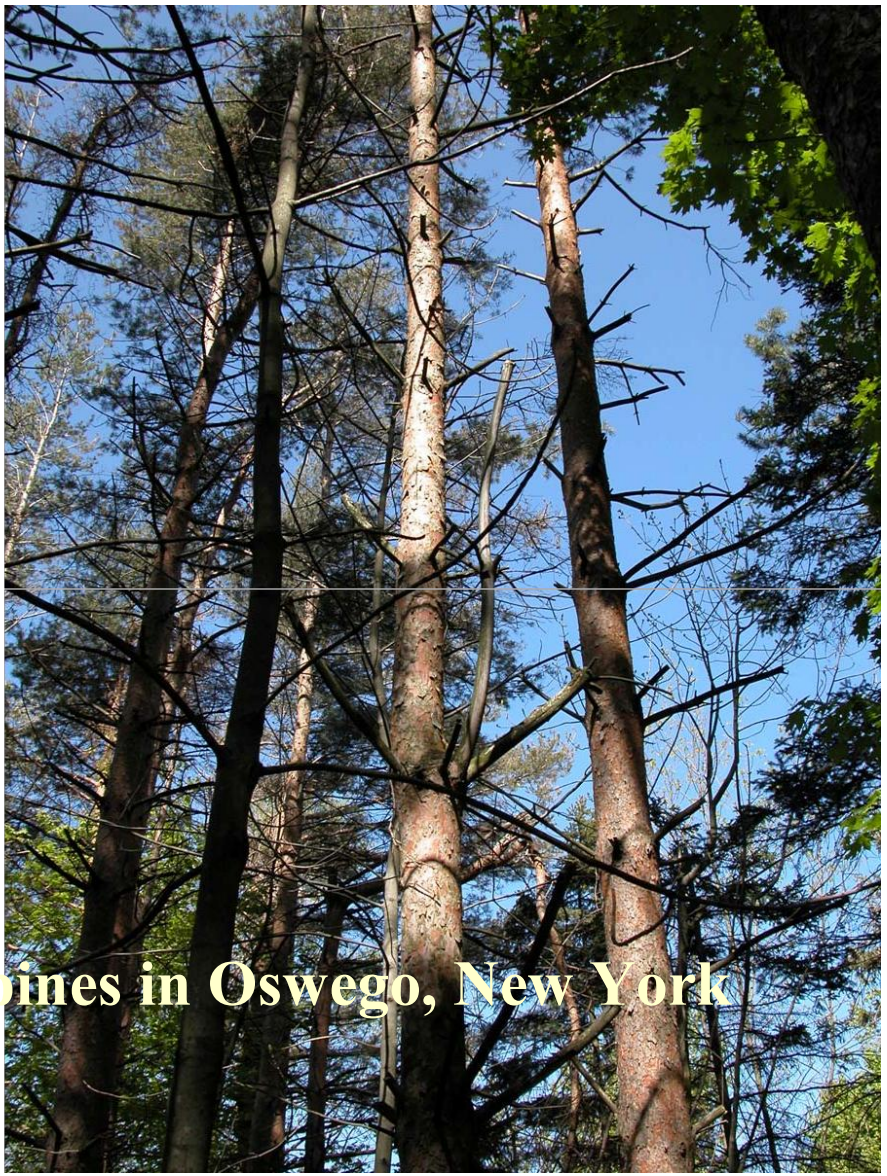
Emergence Holes

***Sirex noctilio* kills North American pines.**
In Australian plantations up to 80% Mortality

In its native range *S. noctilio* is a minor pest like our siricids are here.
In the southern hemisphere it is the most devastating pest of pines.

Will it be a problem in North America

Five S. noctilio infested pines in Oswego, New York
Yielded 900 adults.



Circumstances:

Range: Its in at least 20 counties in New York, 2 in Pennsylvania and in Ontario in the areas bounded by the Great Lakes (300 miles). (Speakers coming up will show delimiting maps)

Vulnerability: The larvae live within trees and would be very difficult to spray.

Dispersal: Adults are good flyers (maybe as much as 50 miles per year). Variable flight period so adults difficult to target.

Natural limits: No shortage of host material east of the plains.

We do not believe *Sirex noctilio* can be eradicated.

Clearly *Sirex noctilio* presents a threat to U.S. Forestry

What can we do about it?

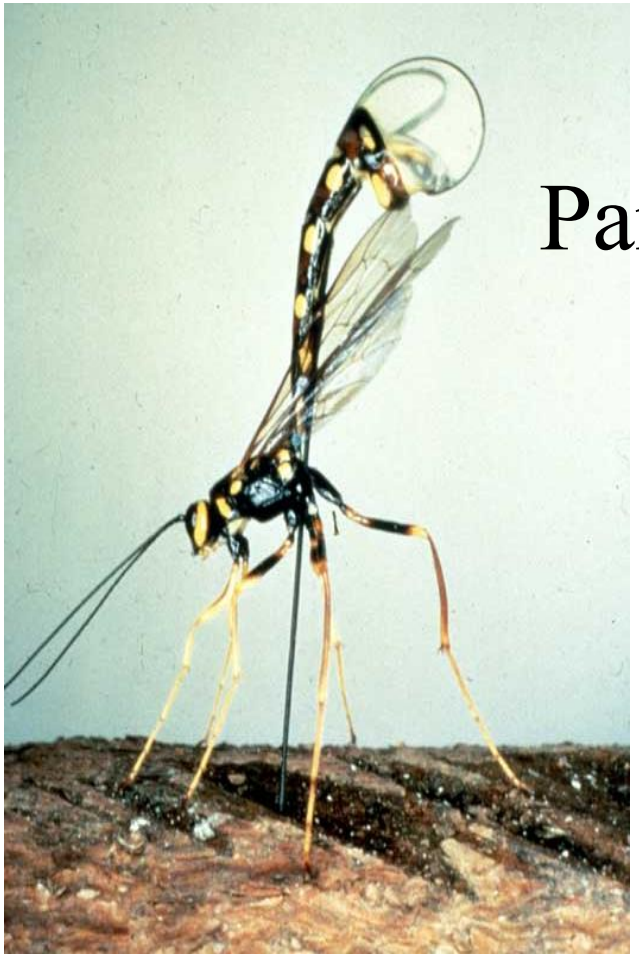
What do the Southern Hemisphere countries do about *Sirex noctilio*?

The Australians developed a control program using:

- **Silvicultural control**
- **Biological Control using**
  - **Parasitoid wasps**
    - **Rhyssine ichneumonids**
    - **Ibaliids**
  - **Parasitic nematode**
    - ***Beddingia* (=*Deladenus*) *siricidicola***

No thinning 68% loss, pre-commercial thinning no loss

Partial control with parasitoids



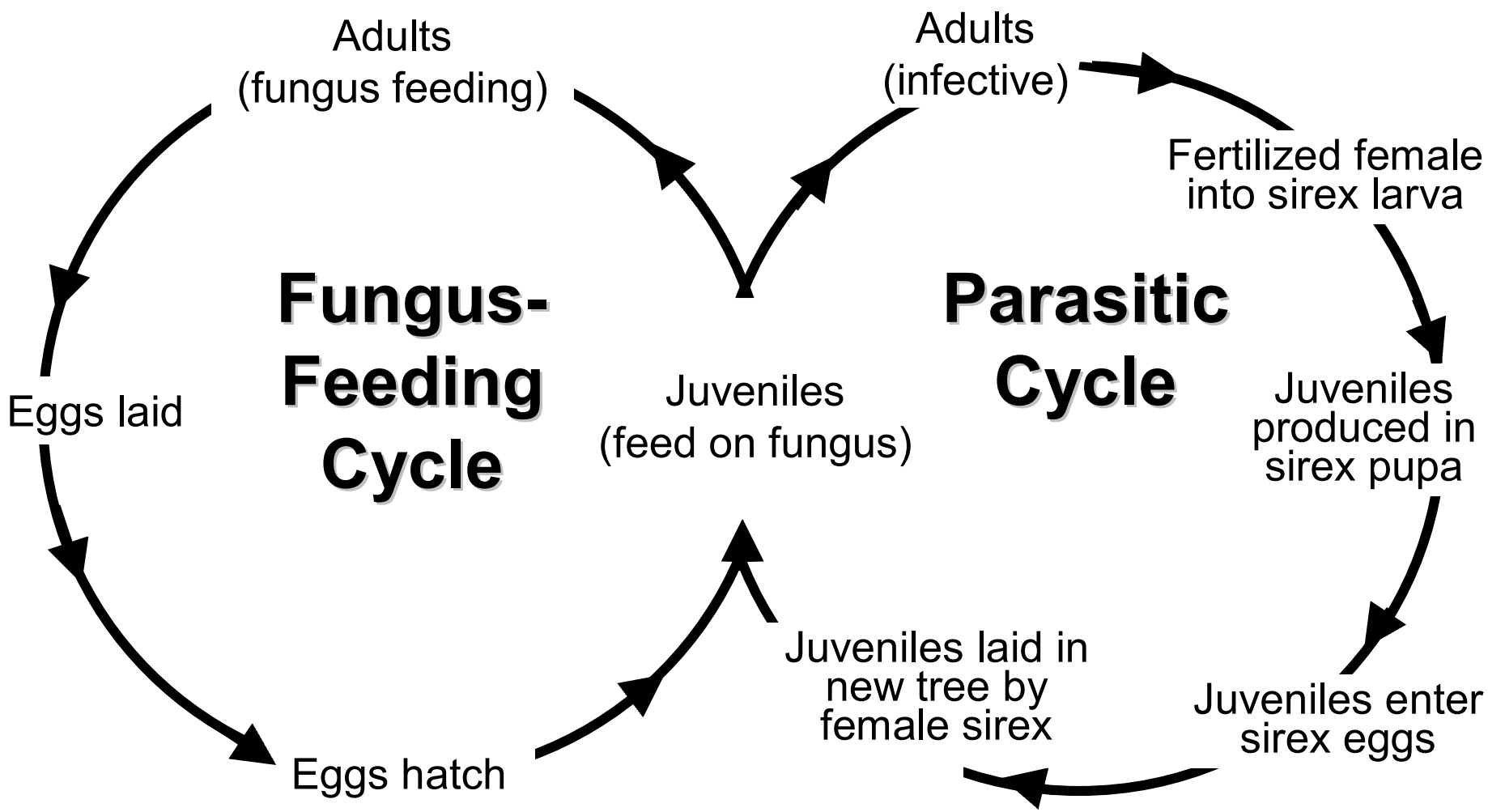
Megarhyssa sp.

Ibalia sp.

Parasitoids help but tend to be density independent.


The Nematode
Beddingia (=Deladenus) siricidicola

NEMATODE LIFE CYCLE



Bedding 1972


Fungus specific
Virulent strains
Easy to grow


Trap Trees used for
Sirex detection
Application of nematodes
Nematodes reduce *Sirex* below economic
levels in 5 years

Good control with nematode

Australia: yes

South Africa: growing pains

Will the Nematode Work in North America?

Ecological considerations:

Premise: The North American pine ecosystem is more ecologically complex than Southern Hemisphere pine plantations

Northern	Southern
100+ conifers in 12 genera	Single pine monoculture
20 species native Siricidae	Single exotic siricid
Many conifer feeding insects	Few pine feeding insects
Native wood decay fungi	One exotic fungus
Native nematodes	One exotic nematode
Many native parasitoids	Few introduced parasitoids

Some of the Possible Ecological Interactions

Tree x fungus:

Amylostereum wood decay studies

Fungus x fungus:

Somatic antagonism studies

Nematode x fungus:

Test nematodes on WDF

Nematode x insects:

Non target host-testing

Tree x Fungus interactions

How does *areolatum* compare to native *chailletii*

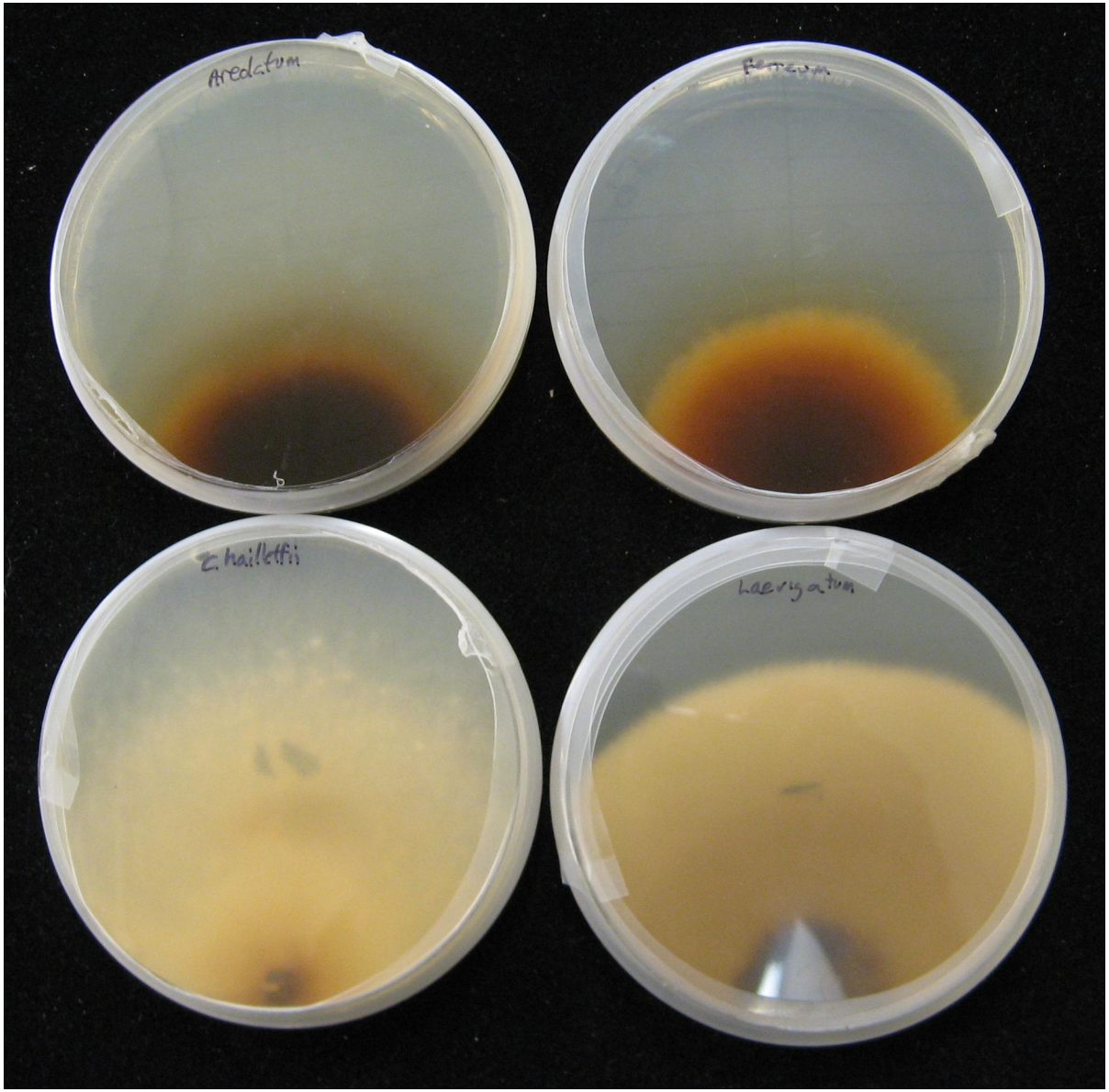
36 species of conifers in 10 genera, 4 bottomland hardwoods

4 species of *Amylostereum* (3 isolates each)

areolatum, chailletii, laevigatum, ferreum

Nematode x fungus:

Test nematode survival and growth on WDF



Nematode x insects:

Non target host-testing

Inoculate infested logs with fungus and nematodes. Dissect adults on emergence.

Urographis fasciatus

Monochamus titillator

Xylotrechus sagittatus

Will the Nematode Work in North America?

Practical considerations:

Develop identification methods

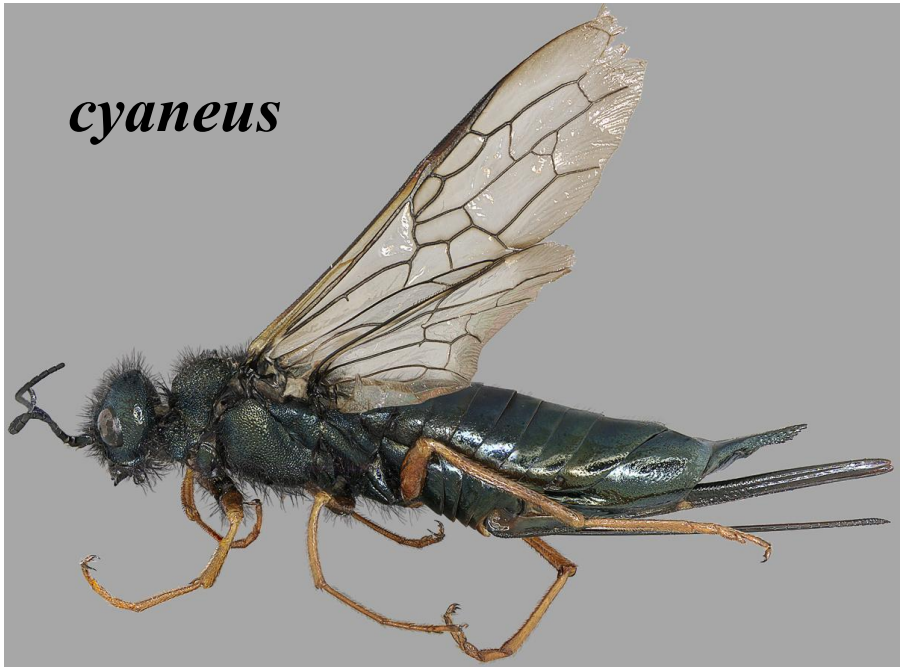
- **Identify larvae with CO I**
- **Microsatellites to locate source of *Sirex***
- **Microsatellites for fungal host race formation**
- **Identify nematode species races??**

Develop better traps and lures

- **Chemistry, EAD's, Field testing**

Develop trap tree technology

- **Best phenology for trap trees**
- **Competitive exclusion (e.g. *Sirex* vs other insects)**


cyaneus


juvencus


noctilio


varipes

Conclusions:

We have a new invasive exotic insect that kills pines.

It is likely to spread and can not be eradicated.

We have a classical biological control agent that has worked in Australia.

We have the plan the Australians used to control *Sirex noctilio*.

We need to do some research to adapt the system to North America.

It will be a long term program but it has the potential to be effective.

Acknowledgements :

USDA Forest Service FHP
The State of New York
Animal Plant Health Inspection Service
Oregon Department of Agriculture
Dan Wilson, Ted Leininger, Dennis Haugen,
Don Duerr, Lynn Evans-Goldner, Jim Labonte
Rick Hoebeke, Vic Mastro, David Smith, Bob Haack
Ethan Angell, Yvonne DeMarino, Kevin Dodds,
Sue Ellis, Harry Fulton, Paul Wrege, Noel Schneeburger
Bob Mungari, Darryl Jewett, Jim Meeker, Brian Scheffler,
Earl Taliercio, Edson Tadeu Iede, Dick Bashford, Meg Allen,
Doug Street, Vicky Klasmer, Ron Billings and many others.

Special thanks to Amy Abel and Charisse Oberle